Outdoor luminescence imaging strategies for drone-based PV array inspection

Benatto, Gisele Alves dos Reis; Riedel, Nicholas; Mantel, Claire; Thorsteinsson, Sune; Poulsen, Peter Behrensdorff; Forchhammer, Søren; H. B. Frederiksen, Kenn; Vedde, Jan; Parikh, Harsh; Spataru, Sergiu

Total number of authors:
11

Published in:
Book of Abstracts Sustain 2017

Publication date:
2017

Document Version
Publisher's PDF, also known as Version of record

Outdoor luminescence imaging strategies for drone-based PV array inspection

Gisele A. dos Reis Benatto[1]*, Nicholas Riedel[1], Claire Mantel[1], Sune Thorsteinsson[1], Peter B. Poulsen[1], Søren Forchhammer[1], Kenn H. B. Frederiksen[2], Jan Vedde[3], Harsh Parikh[4], Sergiu Spataru[4] and Dezso Sera[4]

1: Department of Photonics Engineering, Technical University of Denmark, Frederiksborgvej 399, 4000, Roskilde, Denmark
2: Kenergy, Grønningen 43, 8700, Horsens, Denmark
3: SiCon Silicon & PV consulting, J N Vinthersvej 5, 3460, Birkerød, Denmark
4: Aalborg University, Pontoppidanstraede 101, 9220, Aalborg, Denmark
*Corresponding author email: garb@fotonik.dtu.dk

Regular fault detection for effective maintenance is highly important to ensure expected return on investment (ROI) of small and large-scale photovoltaic (PV) installations. Present day PV panels are designed to operate for 25-30 years, however field experience shows that after 11-12 years of operation, 2% or more of all PV panels fail [1].

In practice, the frequency and inspection detail level is often limited by manpower and cost. Presently, drone-based infrared (IR) thermography inspection of solar plants is a reality [2], [3]. The accuracy of thermographic fault detection though, presents limitations – primarily related to deconvoluting the failure signature into failure type and severity, which can be overcome when performed in combination to electro-(EL) or photo-(PL) luminescence imaging of the panels. The combination of defect detection techniques has been already tested in laboratory [1], [4], although many limitations still need to be addressed in order to obtain image acquisition outdoors and integrate, automate and optimize the imaging system in a drone. The concept of PL/EL in a drone is illustrated in Fig. 1.

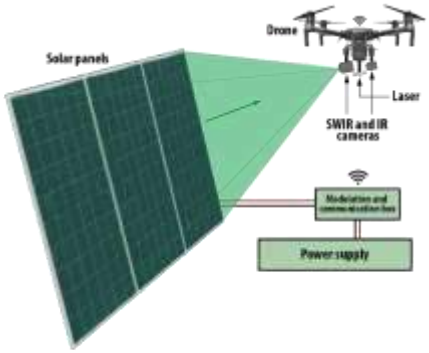

Fig. 1. Concept of automated drone inspection.

In this work, we present the results corresponding to the development of two luminescence-imaging strategies for PV modules defect detection in outdoor conditions, with the aim of choosing the most suitable method for implementation on a drone-based PV plant inspection system.

[1] M. Köntges *et al.*, "Review of Failures of Photovoltaic Modules," *IEA-Photovoltaic Power Syst. Program.*, pp. 1–140, 2014.

[2] S. Dotenco *et al.*, "Automatic detection and analysis of photovoltaic modules in aerial infrared imagery," *2016 IEEE Winter Conf. Appl. Comput. Vis.*, pp. 1–9, 2016.

[3] D. Kint and S. Muñoz-Guerra, "A review on the potential biodegradability of poly(ethylene terephthalate)," *Polym. Int.*, vol. 48, no. 5, pp. 346–352, May 1999.

[4] S. Johnston and T. Silverman, "Photoluminescence and Electroluminescence Imaging Workstation," *NREL*, 2015.